

Remote Streaming & Visualization of ECCO Data with Jupyter Notebook and IDX

Nina McCurdy/NASA Ames

but first!...

<https://data.nas.nasa.gov/viz/vizdata/l1c4320/>

Visualizations of the ECCO Project's 1/48° MITgcm Simulation (aka l1c4320)

This page provides access to precomputed visualizations of the Estimating the Circulation and Climate of the Ocean (ECCO, <https://ecco-group.org>) Project's 1/48° Massachusetts Institute of Technology general circulation model (MITgcm, <https://mitgcm.org>) simulation, a 14-month global simulation of the ocean (September 2011 to November 2012) that resolves internal tides and admits submesoscale and internal-gravity-wave variability.

The visualizations make accessible nearly all of the output from the simulation: all scalars, all levels, and all regions. A number of different resolutions are available, from single animations that show a global view to regional closeups that are nearly the same resolution as the simulation.

The different resolutions are organized into five series of animations. Three series show most of the globe, and two show the Arctic. The highest resolution series showing the globe has 128 different views organized into 8 rows and 16 columns. The medium resolution global series has 8 views that roughly divide the domain into eighths, and is organized into two rows each having 4 columns. The lowest resolution global series has a single global view. The high resolution Arctic series has 26 views organized into 6 rows and 5 columns (four views are blank), and the low resolution Arctic series has a single view.

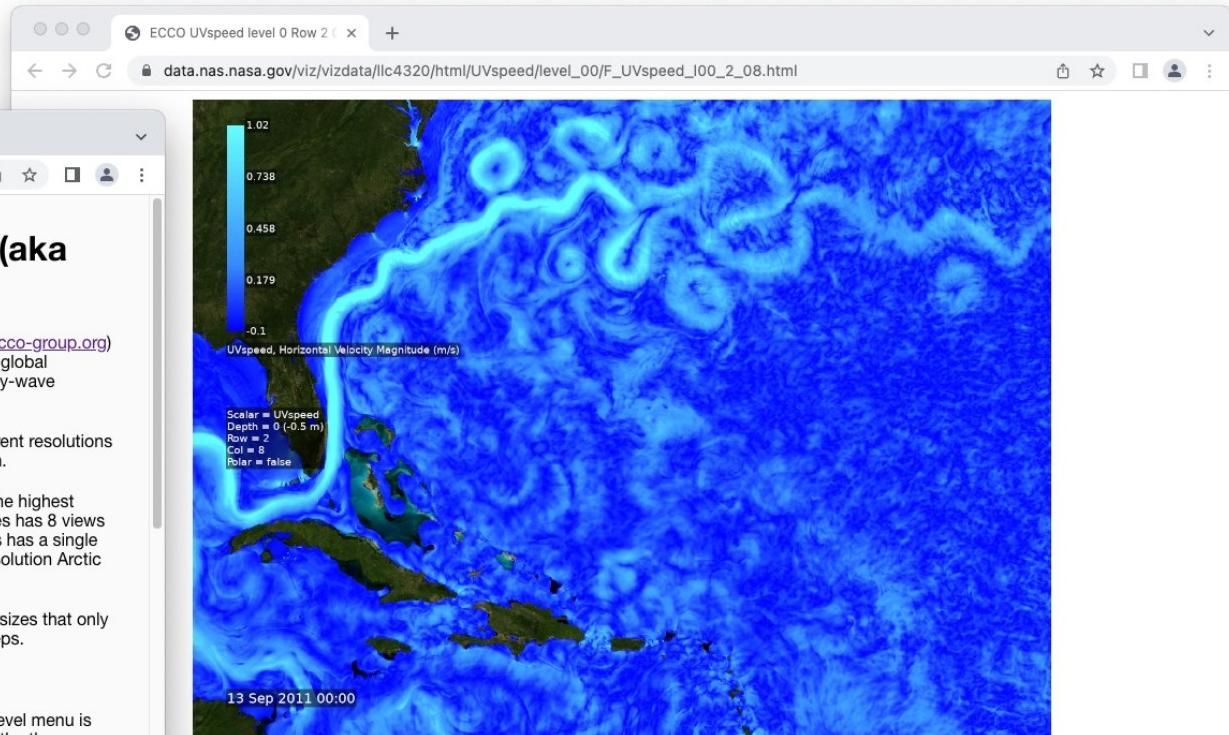
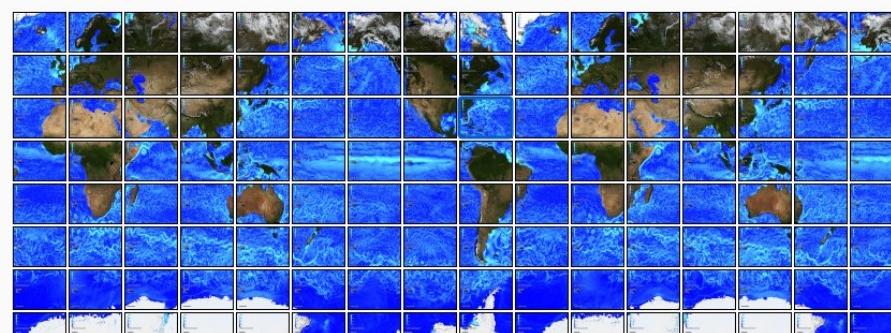
Each series of views has visualizations available in two or three different animation resolution sizes, ranging from about 800 by 600 to sizes that only fit on a 4K monitor. Finally, the animations are available with different time steps, ranging from one hour time steps to one day time steps.

For more information about using this page, the ECCO group has a [web page with detailed instructions](#).

Use the menus below to select the animation series, scalar value, and simulation level (depth). A scalar must be selected before the Level menu is populated as the number of available levels vary by scalar. Selecting a 2D scalar automatically selects the single available level. Once the three selections are made, an image map appears below that shows thumbnails of each available view. Clicking on a thumbnail will open a new tab with a page that has links to animations for the available resolutions and time steps.

| | | |
|--------------------------------------|---|----------------------------------|
| Series 128 regions (2.5km) | Scalar UVspeed (horizontal speed) | Level Level 0 (-0.5 m) |
|--------------------------------------|---|----------------------------------|

Click on one of the 128 images below to see the available animations for UVspeed level 0 at that geographic location in a new tab.



I'll select a visualization of UVspeed (horizontal speed) level 0 (depth -0.5 m) located at row 2 column 8 in the 128-region series of animations. The for either a MP4 animation or a full size image. Animations are available for different resolutions and image sizes, and for a range of time steps. The sizes

| Timestep | Animation Pixel Resolution and File Size | |
|----------|--|--|
| | 5.4 km / 800x600 | 2.7 km / 1600x1200 |
| 1 hour | 587 MB Play MP4 Download MP4 Image | 1.5 GB Play MP4 Download MP4 Image |
| 3 hours | 251 MB Play MP4 Download MP4 Image | 716 MB Play MP4 Download MP4 Image |
| 6 hours | 132 MB Play MP4 Download MP4 Image | 367 MB Play MP4 Download MP4 Image |
| 12 hours | 64 MB Play MP4 Download MP4 Image | 183 MB Play MP4 Download MP4 Image |
| 24 hours | 34 MB Play MP4 Download MP4 Image | 96 MB Play MP4 Download MP4 Image |

[Play MP4](#)

<https://data.nas.nasa.gov/viz/vizdata/l1c4320/>

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| Series | Scalar | Level |
|--------|--------|---------------------|
| Series | Scalar | Select scalar first |

Note: The menus are sometimes unresponsive when using Safari and returning to this page using the browser Back function. The work-around is to reload the page or to reselect a different value in one of the working menus.

Model output from the 1/48° MITgcm simulation is available at <https://data.nas.nasa.gov/ecco/>. Technical aspects of the visualization are described in Ellsworth et al. (2017). The MITgcm is described in Marshall et al. (1997 a, b). The 1/48° simulation has resulted in more than 80 science publications (see References).

References

Arbic, B. K., Alford, M. H., Ansong, J. K., Buijsman, M. C., Ciotti, R. B., Farrar, J. T., Hallberg, R. W., Henze, C. E., Hill, C. N., Luecke, C. A., Menemenlis, D., Metzger, E. J., Müller, M., Nelson, A. D., Nelson, B. C., Ngodock, H. E., Ponte, R. M., Richman, J. G., Savage, A. C., ... Zhao, Z. (2018). A Primer on Global Internal Tide and Internal Gravity Wave Continuum Modeling in HYCOM and MITgcm. In E. P. Chassignet, A. Pascual, J. Tintoré, & J. Verron (Eds.), *New Frontiers in Operational Oceanography* (pp. 30–392). GODAE OceanView <https://doi.org/10.17125/gov2018.ch13>

Ardhuin, F., Aksenov, Y., Benetazzo, A., Bertino, L., Brandt, P., Caubet, E., Chapron, B., Collard, F., Cravatte, S., Delouis, J. M., Dias, F., Dibarboore, G., Gaultier, L., Johannessen, J., Korosov, A., Manucharyan, G., Menemenlis, D., Menendez, M., Monnier, G., ... Xie, J. (2018). Measuring currents, ice drift, and waves from space: The Sea surface Kinematics Multiscale monitoring (SKIM) concept. *Ocean Sci.*, 14(3), 337–354. <https://doi.org/10.5194/os-14-337-2018>

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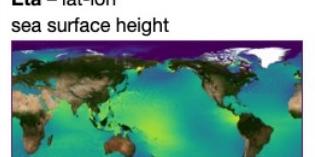
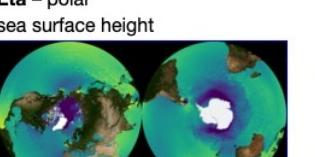
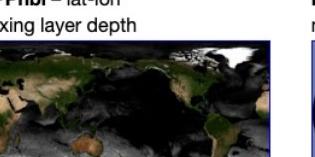
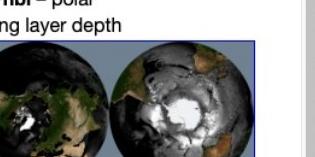
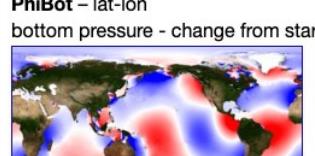
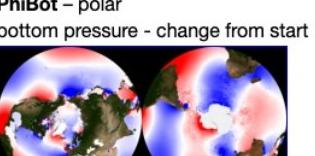
https://data.nas.nasa.gov/viz/vizdata/DYAMOND_c1440_llc2160/MITgcm/

**2021 GEOS5 / MITgcm Coupled Simulation
(c1440_llc2160)**

MITgcm Fields

[Show GEOS Fields](#)

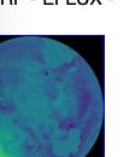
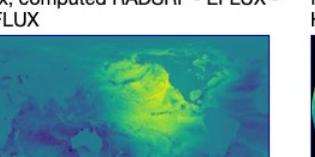
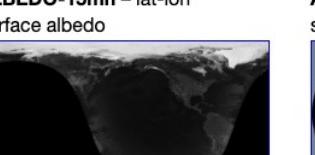
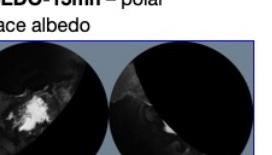
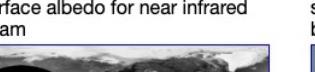
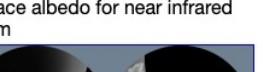
[HD MP4 Directory Listing](#) [4K MP4 Directory Listing](#) [Images Directory Listing](#)

| | | | |
|--|--|---|--|
| Eta – lat-lon sea surface height  HD MP4 4K MP4 4K Image | Eta – polar sea surface height  HD MP4 4K MP4 4K Image | KPPhbl – lat-lon mixing layer depth  HD MP4 4K MP4 4K Image | KPPhbl – polar mixing layer depth  HD MP4 4K MP4 4K Image |
| PhiBot – lat-lon bottom pressure - change from start  HD MP4 4K MP4 4K Image | PhiBot – polar bottom pressure - change from start  HD MP4 4K MP4 4K Image | Slarea – lat-lon fractional ice-covered area  HD MP4 4K MP4 4K Image | Slarea – polar fractional ice-covered area  HD MP4 4K MP4 4K Image |

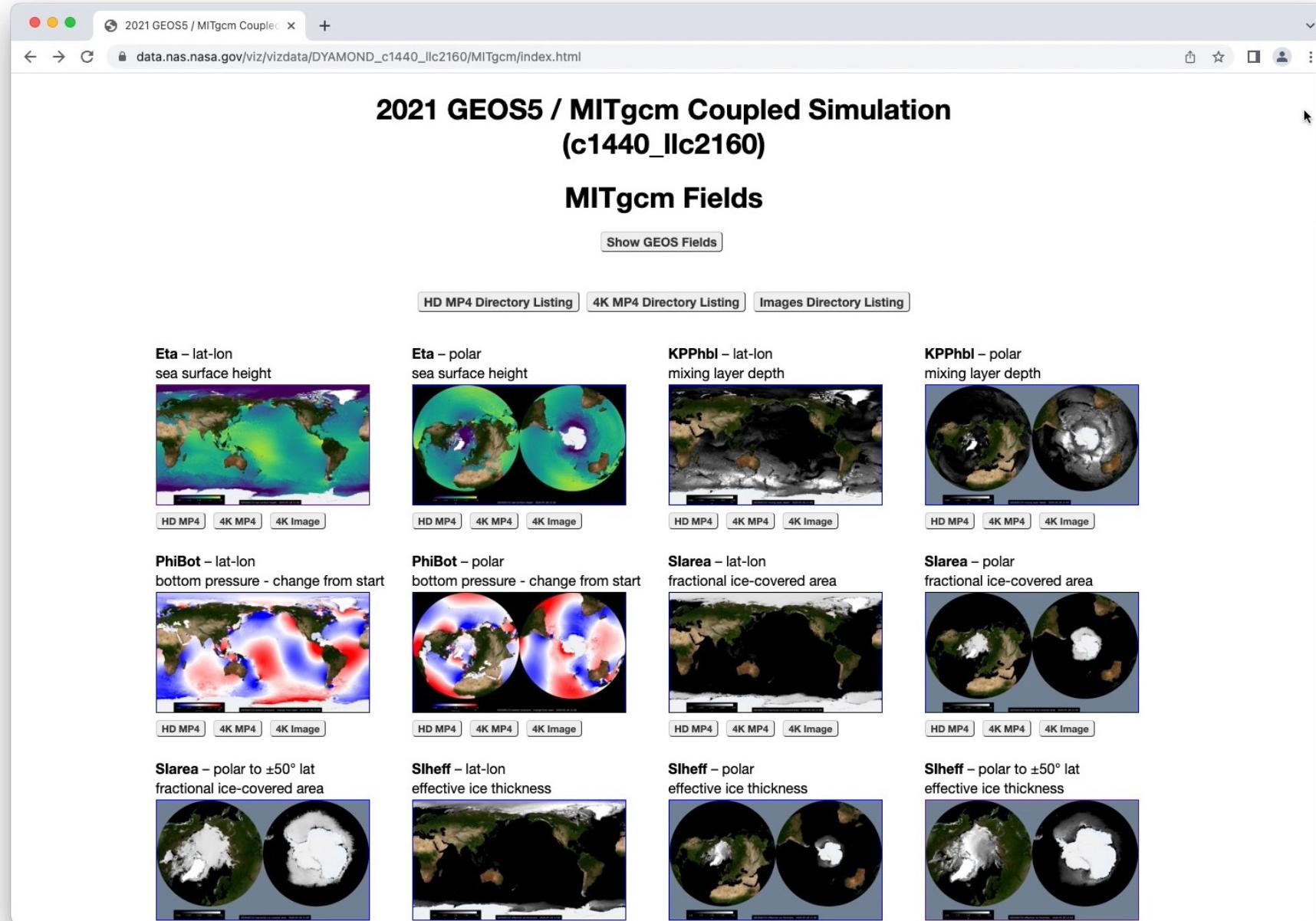
GEOS Fields

[Show MITgcm Fields](#)

[Listing](#) [4K MP4 Directory Listing](#) [Images Directory Listing](#)

| | | |
|--|--|--|
| atmQflux-15mn – lat-lon atmosphere net upward surface heat flux; computed RADSRF - EFLUX - HFLUX  4K Image | atmQflux-15mn – polar atmosphere net upward surface heat flux; computed RADSRF - EFLUX - HFLUX  HD MP4 4K MP4 4K Image | atmQflux-15mn – polar atmosphere net upward surface heat flux; computed RADSRF - EFLUX - HFLUX  HD MP4 4K MP4 4K Image |
| ALBEDO-15mn – lat-lon surface albedo  4K Image | ALBEDO-15mn – polar surface albedo  HD MP4 4K MP4 4K Image | ALBEDO-15mn – polar surface albedo  HD MP4 4K MP4 4K Image |
| ALBNR – lat-lon surface albedo for near infrared beam  4K Image | ALBNR – polar surface albedo for near infrared beam  HD MP4 4K MP4 4K Image | ALBNR – polar surface albedo for near infrared beam  HD MP4 4K MP4 4K Image |

https://data.nas.nasa.gov/viz/vizdata/DYAMOND_c1440_llc2160/MITgcm/



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MITgcm compressed data extraction tool

usage: extract[4320,2160] [options] timesteps fieldNames 3DstartPoint 3Dextent

MITgcm "uncompress" tool

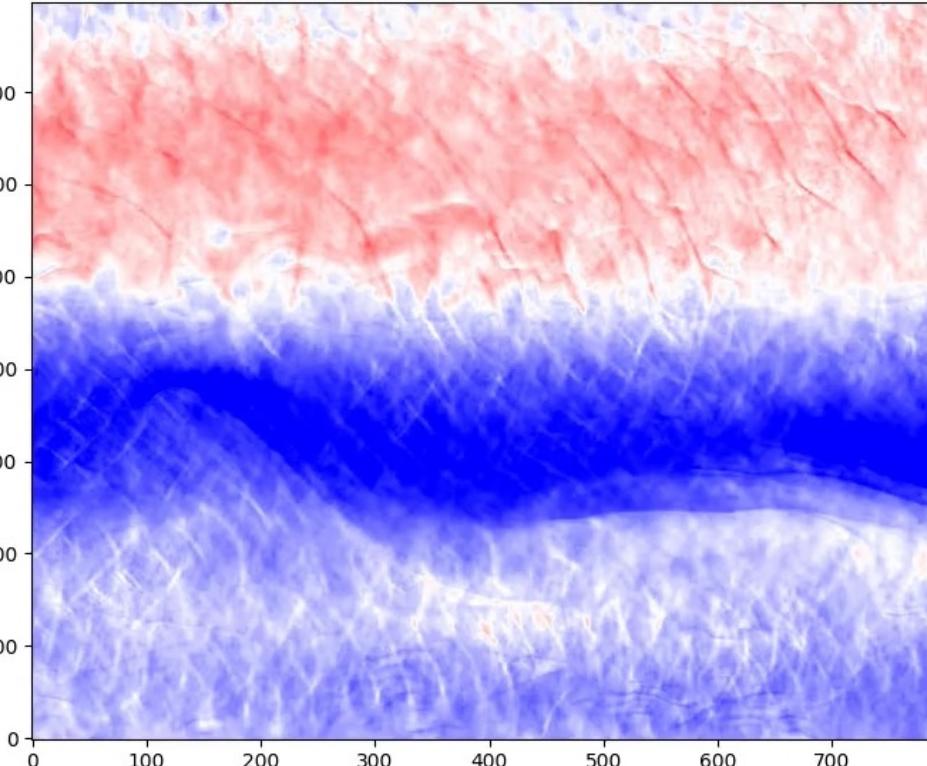
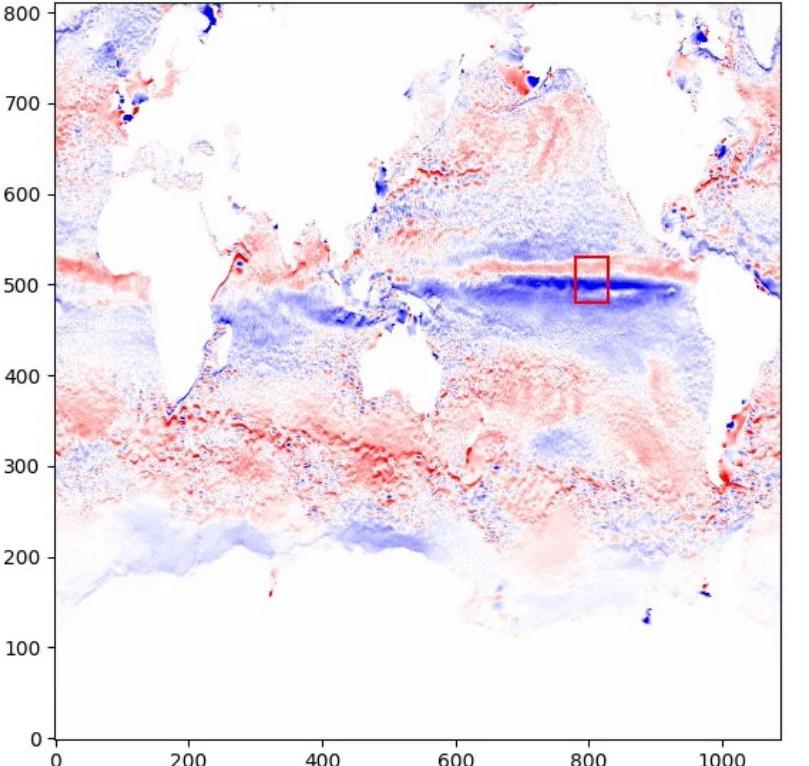
usage: uncompress[4320,2160] [options] timesteps fieldNames

Remote streaming and Visualization with Jupyter Notebook and IDX(2)

- **IDX(2)** : wavelet compression + octree data structure to support progressive decompression of data at different levels of precision and resolution
- **Jupyter Notebooks at NAS** : to support remote streaming and interactive visualization of IDX(2)-formatted data.

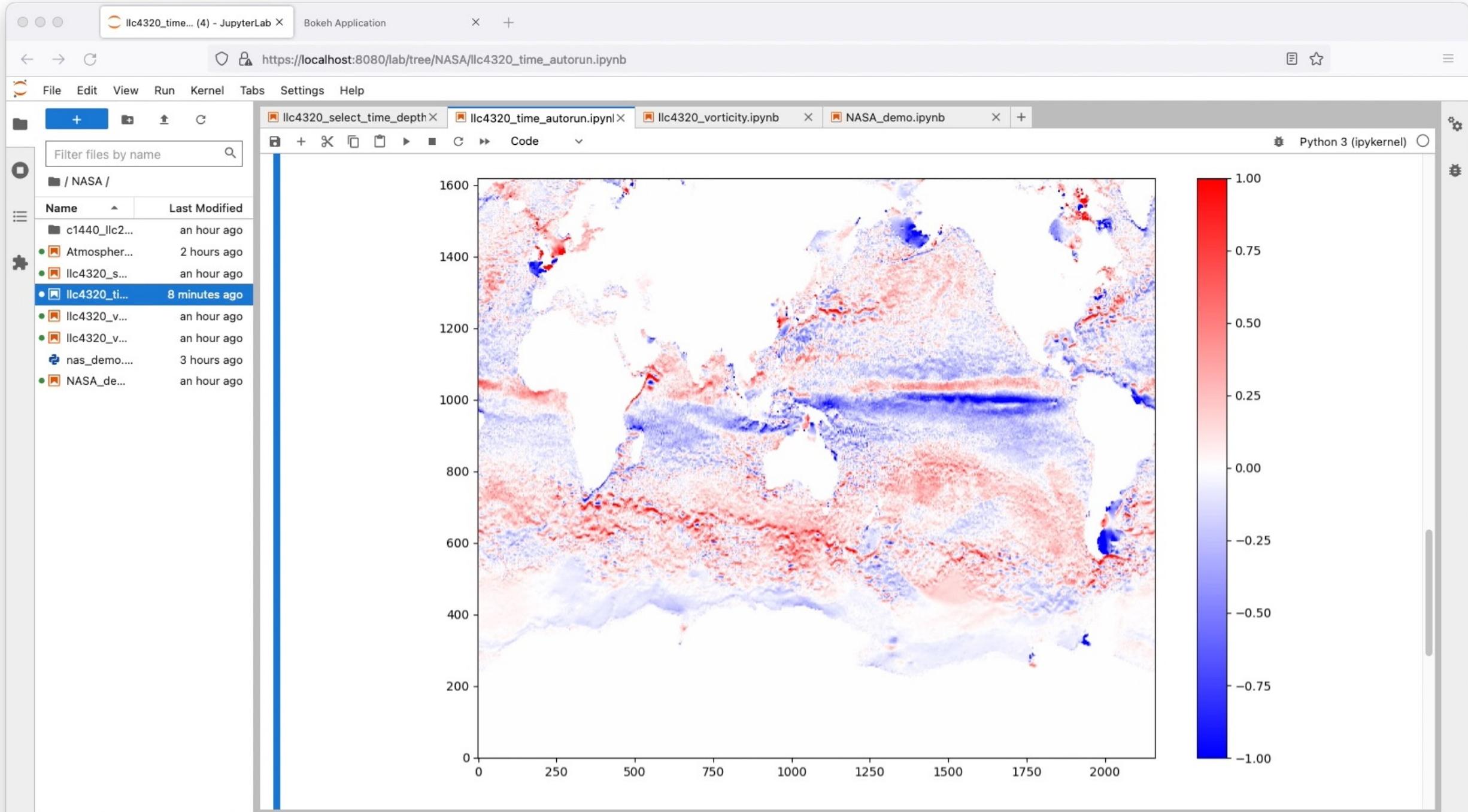


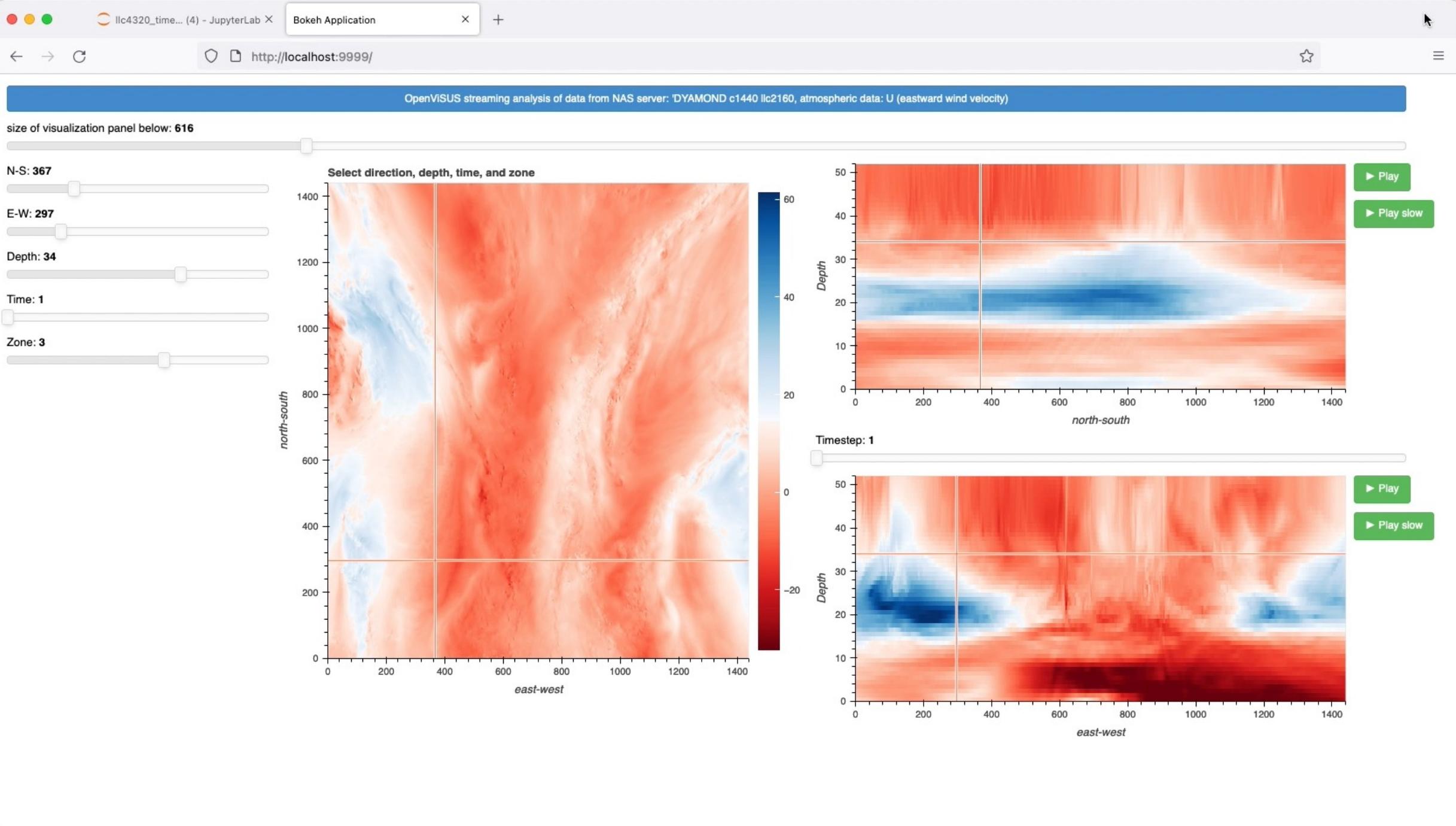
Figure 1



x=555. y=759. [0.000]

x 780y 480t 0





Thank you!
Questions?

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https://data.nas.nasa.gov/viz/vizdata/DYAMOND_c1440_llc2160/MITgcm/

<https://data.nas.nasa.gov/viz/vizdata/llc4320/>